REMARKS

Reconsideration of this application is requested. Claims 16-21, 29 and 32 will be active in the application subsequent to entry of this Amendment. Claims 7-15, 22-28 and 31 have been withdrawn as directed to non-elected subject matter, it being understood that this action is without prejudice to a divisional application directed to the subject matter of these claims. Claims 2-5 have been withdrawn as redundant with claims 17-20. Claim 6 has been rewritten as a new independent claim, claim 32.

Applicants address the issues raised in the outstanding Official Action in the order presented.

Claims directed to non-elected subject matter have been withdrawn.

Claim 6 has been rewritten in independent format and now appears as new claim 32.

In item 3 of the Official Action, claims 2-5, 16-21 and 29 are the subject of a rejection of alleged lack of definiteness. Claims 2-5 have been withdrawn, thus the only item for consideration is the first paragraph of page 3 in which claims 16-21 and 29 in which the examiner questions "use limitations" on how they further limit or define the iron compound catalyst. In point of fact, these are not "use" limitations but rather characterizations of a valuable and important property of the catalyst itself, namely, its catalytic activity in converting carbon monoxide into carbon dioxide. This is a property of the iron compound catalyst and it is appropriately included within claims directed to the catalyst itself. As seen from the description on page 19 of the specification, the catalytic activity capable of converting carbon monoxide into carbon dioxide is a conversion value measured by the following method:

> 2.8×10^{-4} mol of iron oxide particles obtained by heat-treating the iron compound catalyst in air at a temperature of 800°C for 15 minutes, is instantaneously contacted with 6.1×10^{-7} mol of carbon monoxide at a temperature of 250°C and at a space velocity (SV) of 42,400 h^{-1} in an inert gas atmosphere using a pulse catalytic reactor.

Applicants submit that claims 16-21, 29 and new claim 32 are compliant with 35 U.S.C. §112, second paragraph, for the reasons that would be appreciated in this art and as explained above. Reconsideration is requested.

This leaves for consideration the art-based rejections directed to claims 16-21 and 29 (and possibly also new claim 32) as either being anticipated by or obvious over the disclosures of Iglesia et al, U.S. Patent No. 5,036,032. These rejections are respectfully traversed.

The iron compound catalysts of the present invention are used for inhibiting the generation of dioxin. The catalyst may be in the form of iron oxide particles, iron oxide hydroxide particles or mixture thereof and having a specified catalytic activity, namely, capable of converting not at least 15 % of carbon monoxide into carbon dioxide when 2.8×10^{-4} mol of iron oxide particles obtained by heat-treating said iron compound catalyst in air at a temperature of 800°C for 15 minutes, are instantaneously contacted with 6.1×10^{-7} mol of carbon monoxide at a temperature of 250°C at a space velocity (SV) of 42,400 h^{-1} in an inert gas atmosphere using a pulse catalytic reactor. The iron oxide particles or iron oxide hydroxide particles have an average particle size of 0.01 to 2.0 μm, a BET specific surface area of 0.2 to 200 m^2/g, a phosphorus content of less than or equal to 0.02 % by weight, a sulfur content of less than or equal to 0.1 % by weight and a sodium content of less than or equal to 0.2 % by weight.

The catalysts may also take the form of aggregates containing iron oxide particles, iron oxide hydroxide particles or the mixture particles thereof and having a specific surface area of not less than 1.0 m^2/cm^3 when measured under a feed pressure of 1 bar in a dry granulometer, and an average particle size (D_{50}) of 50 % of a total volume thereof, of up to 8.0 μm. They, too, have a specified catalytic activity, as noted above. The iron oxide particles or the iron oxide hydroxide particles have an average particle size of 0.01 to 2.0 μm, a BET specific surface area of 0.2 to 200 m^2/g, a phosphorus content of less than or equal to 0.02 % by weight, a sulfur content of less than or equal to 0.1 % by weight and a sodium content of less than or equal to 0.2 % by weight.

The iron compound catalysts of the present invention enable not only complete combustion of municipal solid wastes but also decomposition of dioxin precursors in an intermittently operated municipal solid waste incinerator, such as mechanical batch incinerators or semi-continuous incinerators, and can prevent generation of dioxin due to the memory effect upon the low-temperature combustion at the start-up or shut-down of an intermittently operated incinerator.

In addition, where the percentage conversion of carbon monoxide into carbon dioxide of the iron oxide particles and/or iron oxide hydroxide particles is less than 15 % by volume, generation of dioxin can not be sufficiently inhibited, hence the requirement in the claims for a minimum catalytic activity.

Other aspects of the claims are also important. In the case where the average particle size of the iron oxide particles and/or iron oxide hydroxide particles is less than 0.01 μm, these particles undergo abrupt sintering upon spray-addition to the incinerator, so that the particle size is thereby increased, making the particles less effective hence difficult to inhibit the generation of dioxin. In the case where the average particle size is more than 2.0 μm, the particles cannot be sufficiently transported with the waste to the rear stage of the incinerator, e.g. to the flue along with a combustion gas, so that it is difficult to inhibit the generation of dioxin.

In the case where the phosphorus content is more than 0.02 % by weight, the sulfur content is more than 0.1 % by weight or the sodium content is more than 0.2 % by weight, since the ability of these to act as a catalyst poison ability is significant, the oxidation activity for converting carbon monoxide into carbon dioxide becomes deteriorated, so that the generation of dioxin cannot be sufficiently inhibited.

Therefore, by using such iron compound catalyst of the present invention, in the incineration of the municipal solid wastes in an intermittently operated incinerator such as mechanical batch incinerators or semi-continuous incinerators, complete combustion of the municipal solid wastes and decomposition dioxin precursors can be achieved, thereby inhibiting generation of dioxin due to a memory effect on low-temperature combustion at the start-up or shut-down of the incinerator.

For example, (a) upon start-up of the incinerator, the concentration of dioxin in the combustion exhaust gas can be reduced to not more than 10 ngTEQ/Nm^3, and during steady operation of the incinerator, the concentration of dioxin in the combustion exhaust gas can be reduced to not more than 8.0 ngTEQ/Nm^3; (b) upon the start-up of the incinerator, the concentration of carbon monoxide in the combustion exhaust gas can be reduced to not more than 120 ppm and during steady operation of the incinerator, the concentration of carbon monoxide in the combustion exhaust gas can be reduced to not more than 50 ppm; and (c) upon the start-up of the incinerator, the concentration of hydrogen chloride in the combustion exhaust gas can be reduced to not more than 60 ppm and during steady operation of the incinerator, the concentration of hydrogen chloride in the combustion exhaust gas can be reduced to not more than 40 ppm. The catalysts of the present invention are designed to meet these objectives.

The first-listed rejection is one of alleged anticipation, yet the record does not establish that the cited document anticipates any or all of the rejected claims. It is admitted on page 4, first and second paragraphs, that this reference "discloses no presence of phosphorus, sulfur, or sodium" reference being made to Example 1. A more precise statement of the deficiencies of this reference is that the contents of these components are not indicated/measured which, in turn, means that it is not possible to determine what disclosure (if any) of the document cited anticipates the claims of the present application. Applicants submit there is no factual basis on which to base an anticipation rejection.

To anticipate a claim, a single reference must disclose the claimed invention with sufficient clarity to prove its existence in the prior art. *Motorola Inc. v. Interdigital Technology Corp.*, 43 U.S.P.Q.2d 1481, 1490 (Fed. Cir. 1997). Anticipation rejections are only proper when the "claimed subject matter is identically disclosed or described in 'the prior art', without *any* need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited reference." *In re Arkley*, 172 U.S.P.Q. 524, 526 (C.C.P.A. 1972); *see also Akzo N.V. v. International Trade*

Commission, 1 U.S.P.Q. 2d 1241, 1246 (Fed. Cir. 1986); *Ex parte Lee,* 31 U.S.P.Q. 2d 1105, 1108 (BPAI 1993). Every element of the challenged claim must be disclosed within this single reference. *PPG Industries Inc. v. Guardian Industries Corp.,* 37 U.S.P.Q.2d 1618, 1624 (Fed. Cir. 1996). Absence from the reference of any claimed element negates anticipation *Kloster Speedsteel AB v. Crucible Inc.* 23 U.S.P.Q. 160 (Fed. Cir. 1986). For these reasons, the anticipation rejection fails on the basis of lack of evidence.

U.S. Patent No. 5,036,032 (Iglesia et al) discloses a highly specific structure, that is coated or rim-type catalysts where substantially all of the catalyst metal is located in the rim or coating on the exterior portion of a catalyst particle and relatively little or none of the catalyst metal is located towards the center of the catalyst particle (refer to column 3, lines 3 to 9).

Further, Iglesia et al disclose that the catalytic metals for Fischer-Tropsch reactions have been widely reported as cobalt, ruthenium, iron and nickel (refer to column 4, lines 19 to 21); and that the cobalt metal is supported on a carrier and, generally, inorganic refractory oxides are employed as supports, and preferred supports are silica, magnesia, alumina, silica-alumina, and titania and of these, supports having an increasing surface area are preferred relative to supports of lower surface area because the higher surface area supports stabilize higher Co dispersions (refer to column 4, lines 38 to 44).

In addition, the Examples of Iglesia et al pertain to Co/SiO_2 Rim catalysts, Co/SiO_2 spheres, Co/SiO_2 powder, $Co/Zr/SiO_2$, and there is no disclosure nor suggestion of using an iron compound catalyst composed of iron oxide particles and/or iron oxide hydroxide particles of the present invention.

Even though Iglesia et al disclose that catalytic metals for Fischer-Tropsch reactions have been widely reported as cobalt, ruthenium, iron and nickel, it is impossible for one of ordinary skill in the art to envision the iron oxide particles or the iron oxide hydroxide particles having an average particle size of 0.01 to 2.0 μm, a BET specific

surface area of 0.2 to 200 m^2/g, a phosphorus content of less than or equal to 0.02 % by weight, a sulfur content of less than or equal to 0.1 % by weight and a sodium content of less than or equal to 0.2 % by weight as required by applicants' claims, from the disclosures of Iglesia et al.

Further, it is impossible for one of ordinary skill in the art to foresee the technical advantages of the present invention, from Iglesia et al, that by using such iron compound catalyst, in the incineration of the municipal solid wastes in an intermittently operated incinerator, complete combustion of the municipal solid wastes and decomposition dioxin precursors can be achieved, thereby inhibiting the generation of dioxin due to a memory effect upon the low-temperature combustion at the start-up or shut-down of the incinerator.

The differences between the present invention and Iglesia et al are not obvious to one of ordinary skill in the art as a routine modification thereof, and it is not obvious to one of ordinary skill in the art to expect the iron compound catalyst of the present invention from Iglesia et al. Accordingly, claims 16-21, 29 and 32 are not properly rejected under 35 U.S.C. § 102(b) or § 103(a), thus these claims should be allowed.

For the above reasons, it is respectfully submitted that the claims are neither anticipated by nor suggested over the disclosures of Iglesia, for the reasons explained above.

For completion of the record, applicants respond to the examiner's comments in item 6 regarding documents which have been cited but not applied to any of the examined claims. U.S. Patent No. 5,656,566 (Ward) discloses a catalyst precursor comprising oxides of iron and chromium and including particles having an aspect ratio of at least 2 and an average (by weight) maximum dimension in the range of 500 to 1500 nm, said precursor being in the form of pellets having minimum and maximum dimensions in the range of 2 to 15 mm.

As explained above, the catalyst precursors of Ward are different from the iron compound catalyst comprising iron oxide particles and/or iron oxide hydroxide particles of the present invention because of the absence of chromium. There is no disclosure nor

suggestion in Ward, of aggregates comprising iron oxide particles and/or iron oxide hydroxide particles. Further, Ward never discloses nor suggests a solution to the problem of how to inhibit or prevent the generation of dioxin upon the low-temperature combustion at start-up or shut-down. So, it is not obvious to one of ordinary skill in the art to expect the iron compound catalyst of the present invention from Ward.

U.S. Patent No. 4,668,658 (Jennings) discloses a pelleted iron oxide catalyst precursor wherein the iron oxide has an O/Fe atomic ratio in the range 1.2 to 1.4, a high surface area and a density of at least 2.6 $g.cm^{-3}$. There is no disclosure nor suggestion in Jennings of a phosphorus content of less than or equal to 0.02 % by weight, a sulfur content of less than or equal to 0.1 % by weight and a sodium content of less than or equal to 0.2 %. Nor does Jennings disclose or suggest a solution to the problem of how to inhibit or prevent the generation of dioxin upon the low-temperature combustion at start-up or shut-down. So, it is not obvious to one of ordinary skill in the art to expect the iron compound catalyst of the present invention from Jennings.

U.S. Patent No. 4,992,406 (Mauldin et al) discloses a support composition for forming a catalyst useful for the conversion of synthesis gas to hydrocarbons the support includes titania in which there is incorporated from 0.1 to about 20 wt% of an alumina or zirconia based binder to provide a titania-binder support having a pore volume ranging from about 0.2 cc/g to about 0.5 cc/g, and surface area ranging from about 8 m^2/g to about 70 m^2/g. Mauldin et al disclose that the iron catalysts, on the other hand, are not really suitable for natural gas conversion due to the high degree of water gas shift activity possessed by iron catalysts (refer to column 1, lines 45 to 48). In addition, there is no disclosure nor suggestion in Mauldin et al, a phosphorus content of less than or equal to 0.02 % by weight, a sulfur content of less than or equal to 0.1 % by weight and a sodium content of less than or equal to 0.2 % by weight in the present invention. Nor do Mauldin et al disclose or suggest a solution to the problem of how to inhibit or prevent the generation of dioxin upon the low-temperature combustion at start-up or shut-down.

So, it is not obvious to one of ordinary skill in the art to expect the iron compound catalyst of the present invention from Mauldin et al.

For the above reasons, it is respectfully submitted that the claims of this application define inventive subject matter.

Reconsideration and favorable action are solicited.

Respectfully submitted,

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